Laser Physics 2017 vol.27 N2

Single-photon frequency conversion via interaction with a three-level atom coupled to a microdisk

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Abstract

The frequency conversion of light has proved to be an important instrument for communication, spectroscopy, imaging and information processing. We theoretically study the frequency conversion of a single photon via its interaction with a λ-type atom coupled to a microdisk. We show that the frequency conversion efficiency approaches unity even in the case of an interaction between clockwise and counterclockwise modes in the microdisk due to surface imperfections. By the use of the Schrieffer-Wolff transformation, we get an effective Hamiltonian that allows us to investigate the dynamics of the system and obtain time and probability of frequency conversion in different conditions.

http://dx.doi.org/10.1088/1555-6611/27/2/025202

Keywords

Schrieffer-Wolff transformation, single-photon frequency conversion, WGM resonator

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